

A Work Project, presented as part of the requirements for the Award of a Master Degree in Economics from the NOVA - School of Business and Economics.

Catastrophic health care expenditures in Portugal and its drivers

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#3119

A Project carried out on the Master in Economics Program, under the supervision of:
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May 23, 2018

Titulo

Abstract

This work assesses levels, drivers and policy implications of catastrophic health expenditures (CHE) in Portugal in the year of 2015. Moreover by following the same methodological approach as studies for previous years, it allows for comparison and assessment of evolution. CHE incidence is calculated. Possible determinants of CHE are estimated through a logistic model. A simulation of additional coverage of pharmaceutical is presented. Main findings point to a decrease in the level of CHE from 2010 to 2015, identify elderly as the most exposed group and estimate a decrease in CHE of up to 1pp as consequence of a higher coverage of pharmaceuticals.

Keywords: Catastrophic health care expenditures (CHE); Portugal; Determinants

1 Introduction

Studies on health economics provide important insights in terms of policy making. The topic itself is very sensitive and deserves special attention. Countries have different methods of financing health sector. The Portuguese Constitution (1976) states the right to universal and comprehensive health services approximately free of charge. However, in 2013 Portugal registered a share of out-of-pocket spending of 28% (OECD, 2015), well above the average across the OECD countries (19%). The economic reasoning behind out-of-pocket payments is closely linked to the concept of efficiency and aims at reducing overconsumption due to moral hazard. However, this can lead individuals having to pay large proportions of their available income resulting in pushing them into poverty. A study for the USA (Merlis, 2002) shows that when a head of households is an older person, a person with disability or is unemployed those households are more likely to be affected when compared to others. For the case of Portugal there are evidence of this being a sizeable issue. Kronenberg and Barros (2014) identify the most vulnerable groups and suggest exemption for some of them, as a way of mitigate the tendency for those incurring in catastrophic health care expenditures. Most recent works as Borges (2013) show that even with enlarged economic exemptions increases in user charges have a harmful effect on the percentage of people incurring in catastrophic health care expenditures.

The objective of this work is to continue the research that has been done on the topic for Portugal, resorting the same data source although for more recent periods. In the light of recent economic crisis, analyzing data from 2015 has increased interest. A comparison is established not only with the previous studies above mentioned but also with research on income inequality and impoverishment as a consequence of the crisis, namely Rodrigues et al. (2016). Lastly, a simulation and scenarios analysis are also done regarding pharmaceuticals' coverage and the effects of hypothetical increases of it on the percentage of people incurring in catastrophic health care expenditures.

The study is organized in the following way. Section 2 provides literature review on the

concept and ways of measuring catastrophic health care expenditures. Section 3 presents the data and methodology. Results are reported in Section 4. Section 5 provides an analysis on the impact of pharmaceuticals' coverage on CHE. A reflection on health care expenditures during crisis aftermath is presented on Section 6. Section 7 concludes.

2 Literature Review

Berki (1986) has firstly introduced the concept of catastrophic expenditure defining it as one which represents a large part of household budget and therefore affects its ability to keep customary standard of living. Russel (1996) pointed out the concern about the opportunity cost of health care spending. This view has been reinforced by later studies which have also been providing different measures of catastrophic expenditures.

Wagstaff and Doorslaer (2003) have firstly applied two different approaches to the concept of catastrophic health care expenditures (CHE). The first one sets the threshold in terms of proportionality of income by considering the OOP payments as a proportion of the income and usually setting the thresholds between 2.5% and 15%. The fact that in this approach same thresholds are used regardless of the financial condition of the household raises issues related to the greater probability of richer households exceeding the threshold with much less severe consequences than those for the poorest households. Authors' second approach introduces the concept of "capacity to pay" and defines it as the total expenditures except the subsistence need. By doing this the authors are able to estimate incidence of CHE after allowing deductions for food expenditure. Health expenditure is therefore considered as a fraction of household income subtracting food expenditure.

Xu et al. (2003) suggests another approach for measuring household's capacity to pay for health care by subtracting the food expenditure of the median household from households' income. Households that spend more than 40% of their capacity to pay on health care are considered to incur in CHE.

To sum up, catastrophic health expenditures are considered to happen when OPP pay-

ments exceed a threshold of the household’s capacity to pay, which in the case of this study has taken several values between 10% and 40%.

3 Data and Methodology

3.1 Survey Description

Data comes from a national representative household survey, the Portuguese Household Budget Survey – *IDEF - Inquérito às Despesas das Famílias* – which included 11398 households interviewed between March of 2015 and March of 2016. The survey was carried out by Statistics of Portugal (INE), the official body in charge of production of data on the country, and represents the most recent edition of data series on household budgets, following the work that has been done since the 60s.

3.2 Dependent Variable

Catastrophic health care expenditure (CHE) occurs when a household’s total out-of-pocket (OOP) healthcare payments equal or exceed a certain threshold of their capacity to pay for non-subsistence spending. The term *catastrophic* is related to what happens to the opportunity cost of health care expenditure when households are not able to spend a given fraction of their resources on other goods and services besides it, due to excessive OOP payments.

For comparison purposes the most common threshold in the literature was used, following the WHO definition and setting it as 40%. Following Wagstaff and Doorslaer (2003) and Xu et al. (2003) CHE is defined with respect to capacity to pay. This last concept corresponds to the difference between total expenditures and the subsistence spending of a household. In this study subsistence needs were computed as the median food expenditure of the households, in line with Xu et al. (2005). Notwithstanding Evetovits et al. (2012) approach was also tested, considering an extended basket including expenses other than food, namely clothing and utility bills. Similarly, and regardless of the adoption of WHO definition of CHE, others

thresholds were tested, namely 10%, 20% and 30%.

Analytically and following Borges (2013), let Y be OOP, x the total household expenditure, $f(x)$ the household subsistence spending and z the defined threshold. A household i will therefore be said to incur in CHE if: $\frac{Y_i}{x_i - f(x_i)} \geq z$. As it is easily perceived, the condition $Y_i > 0$ is imposed, meaning that only OOP payments greater than zero can be considered in the assessment of CHE. It raises a limitation of CHE highlighted by Wagstaff and Doorslaer (2003): the potential exclusion of households in a situation of such poverty that prevent them from having any access to medical care.

3.3 Independent Variables

Poverty Line: In order to be able to relate impoverishment and health care expenditures a poverty line has been computed. OECD approach has been followed as it is easily found in previous related research as in Kronenberg and Barros (2014) and Borges (2013). Therefore, poverty line is defined as 60% of median income. Household income is considered after adjustment using the equivalence square root method. From the poverty line it is therefore derived the concept of poverty rate, computed as the fraction of people under the poverty line in the total of individuals of the different groups.

Set of explanatory variables: the choice of determinants of CHE was made based on the availability of data and in line with the literature on the topic. An initial assessment on the individual significance was made by running logistic regressions for each one of them, allowing to use the statistically significant ones together in the subsequent analyses.

Further descriptive statistics are presented in table 11 in the annex.

3.4 Model

The independent variable above characterized, the incurrence of CHE, takes a binary form, assuming the value 1 if the household incurs in CHE and the value 0 otherwise. Following Kronenberg and Barros (2014) and the general literature on the topic, a logistic regression has been chosen to model the problem. Hence, the probability p of falling into CHE is: $p_i = \Pr(y_i = 1 | x) = F(x'_i \beta) = \frac{e^{x'_i \beta}}{1 + e^{x'_i \beta}}$. $F(\cdot)$ is the logistic cumulative distribution function ensuring that $0 \leq p \leq 1$. The coefficients are log-odds and are interpreted as the variation in the logit for a unit variation in the explanatory variable. In order to make this interpretation more complete and keeping in mind the interest of preserving similarities with previous studies in order to seek their comparability, odds-ratio are reported, following Kronenberg and Barros (2014) and Borges (2013). Odds-ratio provides the ratio of the odds of an event occurring in one group relatively to the odds of another event. When odds-ratio takes the value 1 we face two regressors with the same probability of causing an event, y . If it assumes a value below 1 (but strictly positive), there is a regressor x with lower probability of causing y than the baseline. In an opposite way, when odds-ratio is above 1, the regressor x is more likely to cause y than the one which it is being compared. Marginal effects are computed as AMEs (average marginal effects) due to the fact of being observation specific. Hence they calculate the marginal effect of a regressor for each household in the sample and subsequently present their average.

4 Results

4.1 Incidence of CHE

Tables 1, 2 and 3 present the proportion of Portuguese households incurring in CHE in 2015 by region and income quintile and different measures of catastrophe are computed. In (1) subsistence needs are considered as food expenditures accordingly to WHO definition and in line with Borges (2013) while in (2) the concept becomes broader, considering an extended

Table 1: CHE proportion per income group

	CHE40	CHE30	CHE20	CHE10
1st quintile	0.05085	0.10748	0.22117	0.45597
2nd quintile	0.01462	0.04219	0.12573	0.34962
3rd quintile	0.00044	0.01237	0.06452	0.24790
4th quintile	0.00094	0.00897	0.04627	0.22993
5th quintile	0.00091	0.00272	0.02132	0.16697
Overall (1)	0.01430	0.03632	0.09888	0.29444
Overall (2)	0.04685	0.07940	0.15345	0.35322

Table 2: CHE proportion per household type

	CHE40	CHE30	CHE20	CHE10
1 adult	0.01044	0.02372	0.05598	0.19734
1 elderly	0.05670	0.12107	0.25134	0.52261
2+ adults	0.00329	0.01646	0.04937	0.22379
2+ adults/elderly	0.02386	0.06339	0.17984	0.47187
1 adult + children	0.00000	0.00378	0.04537	0.18904
2+ adults + 1 child	0.00202	0.00605	0.03530	0.17751
2+ adults + 2+ children	0.00000	0.00251	0.02261	0.13379

basket including expenditures in food, clothing and utilities. The remaining analysis for region, income quintiles and household type consider the method in (1).

The results presented for incidence of CHE by household type reveal large disparities. Households including elderlies are clearly the most affected ones, especially one-person households. In fact by relaxing the concept of CHE and focusing on the first column for a CHE level of 10%, one concludes that more than half of the one-elderly households are exposed to

Table 3: CHE proportion per Region

	CHE40	CHE30	CHE20	CHE10
North	0.01589	0.03631	0.09442	0.28961
Center	0.03269	0.05897	0.13462	0.33718
Lisbon	0.00590	0.02006	0.06806	0.24587
Alentejo	0.00804	0.03698	0.10531	0.31511
Algarve	0.00974	0.02746	0.07352	0.26129
Azores	0.01434	0.04167	0.12773	0.33811
Madeira	0.01592	0.04220	0.10748	0.30653

it. In line with this, the second most affected group is the one composed by households with two or more adults and at least one elderly.

Table 4 allows for a comparison between the values for 2015 and those resulting from the three previous Portuguese Household Budget Survey held in 2000, 2005 and 2010, using data from Borges (2013).

Borges (2013) found results for catastrophe in Portugal in 2000, 2005 and 2010 of respectively 5.005%, 3.177% and 2.439%. The result obtained for 2015 (1.43%) reveals a variation of -1.009pp for the last 5 years, slightly higher than the one between 2005 and 2010 (-0.738pp).

Xu et al. (2007) performed an incidence analysis of CHE in 89 countries and found a median level of 1.47%. Therefore, in the time frame for which there are available data, that is, between 2000 and 2015, the last year was the first Portugal performed above the median value, although only slightly.

At a regional level, Center registers more percentage of CHE, followed by North and Madeira. Lisbon has the lowest values. Borges (2013) has reported Azores and Madeira to be the most affected regions in 2010 closely followed by Center.

Concerning income levels, differences are observed. 1st quintile, corresponding to the poorest one, has the higher percentage of incidence. It then continuously decreases until the second two quintiles that in fact register the same value. This is in line with the literature on the topic (Wagstaff and Doorslaer, 2003). When comparing the income quintiles analysis with Borges (2013) results for 2010 it is clear that the poorest quintile was the one that remained more affected. The other four quintiles have registered variations between -0.59pp and -1.07pp. The first one however has only decreased by 0.47pp. The difference in the pattern of CHE occurrence across income quintiles when compared with Borges (2013) may be due to significant changes in the income distribution itself, therefore affecting the determination of the quintiles. However, more data would be needed in order to conclude about the topic.

Comparison on the occurrence of CHE by household type is not possible, since such data is not available from Borges (2013).

Table 4: Comparison between year of analysis and data on previous years (Borges, 2013)

	2000 ¹	2005 ¹	2010 ¹	2015 ²
CHE40	5.005%	3.177%	2.439%	1.43%
<i>Region</i>				
North	3.527%	3.011%	2.439%	1.59%
Center	6.097%	3.836%	2.485%	3.27%
Lisbon	4.990%	2.287%	2.264%	0.59%
Alentejo	7.315%	5.350%	2.969%	0.80%
Algarve	7.794%	2.749%	1.827%	0.97%
Azores	7.331%	2.552%	3.090%	1.43%
Madeira	5.832%	3.964%	3.062%	1.59%
<i>Income quintile</i>				
1st	15.711%	8.519%	5.556%	5.09%
2nd	8.218%	5.558%	2.283%	1.46%
3rd	3.384%	1.930%	1.112%	0.04%
4th	1.417%	0.854%	0.813%	0.09%
5th	0.393%	0.593%	0.681%	0.09%

4.2 Econometric modelling of CHE determinants

Table 5: Margins and Odds Ratio from logistic regression

	(1)	(2)
	Margins	Odds Ratio
Ln(Income)	0.9695*** (0.00)	0.1620*** (0.03)
Illness Benefits	1.0362*** (0.01)	8.0865*** (4.74)
Ratio of seniors in the HH	1.0294** (0.01)	5.4896** (3.77)
Ratio of employed ind. in the HH	0.9887 (0.01)	0.5114 (0.38)
Ratio of unemployed ind. in the HH	0.9923	0.6363

¹Source: Borges (2013).

²Own calculations.

	(0.01)	(0.42)
<i>EDUC</i>		
4th Grade	0.9912**	0.6295**
	(0.00)	(0.12)
6th Grade	0.9823***	0.2911**
	(0.01)	(0.16)
9th Grade	0.9905	0.6037
	(0.01)	(0.27)
High School	0.9774***	0.1185**
	(0.01)	(0.13)
Higher Education	0.9790***	0.1759
	(0.01)	(0.19)
<i>NUTS</i>		
Center	1.0120**	1.6668**
	(0.01)	(0.42)
Lisbon	0.9877***	0.4007***
	(0.00)	(0.14)
Alentejo	0.9874***	0.3896**
	(0.00)	(0.15)
Algarve	0.9906*	0.5335*
	(0.01)	(0.20)
Azores	0.9974	0.8682
	(0.01)	(0.28)
Madeira	1.0055	1.2953
	(0.01)	(0.40)
N	8259	8259

Exponentiated coefficients

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The log-transformed income variable is statistically significant at 1% level. Its odds-ratio is smaller than 1, evidencing that a higher level of income leads to a lower probability of facing CHE, which goes in line with economic intuition.

The fraction of senior people on the household *senior_ratio* is also statistically significant at 1% level and presents an odds-ratio above 1, as expected. Households composed by elderly people are more likely to incur in CHE.

The ratios of employed, unemployed and unable to work people on the household size are all not significant, in contrast with previous literature as Borges (2013) and Kronenberg and Barros (2014) who found significant results for at least one of them.

Regarding age of the head of household none of the dummy variables turned out to be significant, differently from what Borges (2013) found.

Except for 9th grade, all the other variables related to education of the head of household are significant at a 5% level. All the odds-ratio are lower than 1, leading to the interpretation that a degree of education decreases the likelihood of incurring in CHE, when compared to none.

When comparing these results with Borges (2013) for the years of 2000, 2005 and 2010 one finds the same effect of education of the head of household, meaning significance and magnitude of the odds-ratio. Similar thing happens for the ratio of seniors in the household, even though it only holds for 2010 and current results for 2015 present a higher odds-ratio.

5 The impact of pharmaceuticals' coverage on CHE

Pharmaceuticals are the biggest source of health spending, having accounted for more than 71% of the expenditure in health care in 2015. To assess the effects of an increase in coverage

of pharmaceuticals on CHE a simulation is performed under two different scenarios. In the first one it is assumed a price elasticity of demand for the consumption of pharmaceuticals of 0. In the second one, and based on the literature in the topic, lower and upper bounds for price elasticity are used. Accordingly to Ringel et al. (2002) I have set the bounds as -0,1 and -0,33. From the natural interpretation of elasticities, comes that a reduction of 1% in the pharmaceuticals' price leads to a 0,1% or 0,33% increase in their consumption. The Portuguese Authority of Medicines and Health Products, *Infarmed* (Infarmed, 2015), provides data on the average annual prices of pharmaceuticals. Following the 2 scenarios above mentioned I have tested for 3 hypothetical levels of additional coverage. Table 6 presents the expected variation on pharmaceuticals' expenditures.

Table 6: Estimates of variation in pharmaceuticals expenditures

		Δ expenditures		
		e=0	e=-0,1	e=-0,33
Average Annual Price (2015)	10,40€	-	-	-
Price under addit. coverage of 10%	9,36€	-10%	-9%	-6,7%
Price under addit. coverage of 20%	8,32€	-20%	-18%	-13,4%
Price under addit. coverage of 50%	5,20€	-50%	-45%	-33,5%

From this reduction on pharmaceuticals' expenditures – and consequently in health expenditures – two scenarios are possible: households can allocate the disposable income to any other good or service, keeping their total expenditures level constant; or they can decide not to allocate the surplus, causing the total expenditures to decrease. The impacts of both alternatives on CHE are detailed on tables 7 and 8.

Table 7: Estimates for occurrence of CHE under additional coverage – constant level of household expenditures

	e=0	e=-0.1	e=-0.33	Reference
10%	0.01149	0.01193	0.01246	
20%	0.00956	0.01009	0.01079	0.01430
50%	0.00430	0.00491	0.00649	

Table 8: Estimates for occurrence of CHE under additional coverage - adjusted household expenditures

	e=0	e=-0.1	e=-0.33	Reference
10%	0.01281	0.01290	0.01325	
20%	0.01097	0.01132	0.01202	0.01430
50%	0.00649	0.00728	0.00921	

6 Health care expenditures during crisis aftermath

The recent past of the country, which faced an intense economic crisis, was particularly demanding. Rodrigues et al. (2016) show a decrease in income of more than 12% between 2009 and 2014. Moreover, they report that between 2009 and 2012 69% of the individuals suffered from that income decrease. In the same study the authors focus on understanding which groups were most affected. In this section a comparison is made between Rodrigues et al. (2016) findings and the sample being analyzed.

Table 9: Variation of income and poverty rates by age group of the head of household between 2009 and 2014

Age group of the HH	Δ equivalent income	Δ poverty rate (pp)
≤ 24	-29%	11.5
25 – 34	-13%	6.3
35 – 44	-11%	-0.8
45 – 54	-19%	3.2
55 – 64	-10%	1.2
≥ 65	-7%	-3.4
Total	-12%	1.6

Source: Rodrigues et al (2016)

Rodrigues et al. (2016) findings show that households which individual of reference is a senior (last age group) were the least affected by the decrease in income. Both the variation in equivalent income and the poverty rate show the best evolution in the time frame considered. This data contrasts with the current analysis, as we can see that the elderly age group still reveals the higher percentage of CHE in 2015. However, another variables need to be taken into account such as the natural increased likelihood of older people to become sick and

Table 10: Percentage of occurrence of CHE and poverty rate for 2015

Age group of the HH	CHE40	Poverty rate
-24	0.00637	0.29936
25-34	0.00207	0.16322
35-44	0.00088	0.14905
45-54	0.00348	0.15057
55-64	0.00784	0.15821
65+	0.03751	0.20023
Total	0.01430	0.17029

therefore to incur in higher health care expenditures.

On the other hand, when analyzing the poverty rate for 2015 it becomes easier to relate with the referred literature. In fact the youngest age group reveals the third highest percentage of CHE in the sample. The authors emphasize the low level of income of this age group, a circumstance that persists in the year of this analysis. It is intuitively concluded that this condition turns this population group into a vulnerable one, when it comes to CHE.

7 Conclusion

This work analyses data from 2015 on CHE allowing it to be compared with previous years. Regarding the occurrence of CHE it registers a decrease from 2.439% to 1.43%, evidencing an improvement of the overall condition of the households related to CHE. Occurrence by household type shows a lot of heterogeneity across categories with clear evidence of the unfavourable condition of the elderly. The two household groups containing people above 65 years old register the higher values for CHE occurrence. The analysis by income quintiles reveals a predominance of a higher percentage of CHE at lower income levels. Occurrence of CHE by income quintiles show a different pattern from the last years, suggesting a change in income distribution which couldn't be adequately investigated in this context.

Concerning the determinants of CHE only income, receiving illness benefits, fraction of people above 65 years old on the household, region and education of the head of household are statistically significant in the analysis.

The high poverty rate on both the lowest and the highest age groups should get attention from policy makers. The latest situation, of the highest age group, when put together with the currently percentage of CHE, confirms that the elderly are a group that needs protection from against catastrophe.

The simulation on additional coverage of pharmaceuticals has revealed the potential decrease in CHE occurrence. For an additional 10% coverage level, the estimates point to a reduction between 0.105pp and 0.281pp. For the scenario of 20% additional coverage those values vary between 0.228pp and 0.474pp. Lastly, an additional 50% coverage would result in a decrease in the percentage of CHE between 0.509 and 1.00 pp. A policy with similar results to those of the additional coverage may be to ensure the decrease of pharmaceuticals' price through, for example, promotion of generics.

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8 Annex

Table 11: Descriptive statistics

Name	Variable	Description	Mean	St. Dev.	Min	Max
income	Income	Disposable annual income of the household	23,088	17,935	468	354,270
ln_inc	Ln(Income)	Log-transformed disposable annual income of the household	9.829	0.661	6.148	12.778
d_h_ben	Illness Benefits	Equals 1 if the household receives illness benefits; 0 otherwise	0.022	0.147	0	1
gender	Gender of the HH head	Equals 1 if HH is male and 0 if female	0.417	0.493	0.	1
senior_ratio	Ratio of seniors in the HH	Number of individuals above 65 / Number of household members	0.295	0.418	0	1
ratio_emp	Ratio of employed ind. in the HH	Number of employed individuals / Number of household members	0.369	0.347	0	1
ratio_unemp	Ratio of unemployed ind. in the HH	Number of unemployed individuals / Number of household members	0.085	0.199	0	1
ratio_incap_work	Ratio of permanently disabled ind. in the HH	Number of permanently disabled individuals / Number of household members	0.144	0.224	0	1
hh_size	Size of the HH		2.552	1.237	1	16
pfrm	Primary source of income for HH head	1=Employed; 2=self-employed; 3=rents; 4=pension benefits; 5=Other public benefits; 6=family transfers / others	2.448	1.542	1	6
age_b_brackets	Age of the HH head	1=-24; 2=25-34; 3=35-44; 4=45-54; 5=55-64; 6=65+	4.403	1.391	1	6
Nuts2	Region of the HH	1=North; 2=Center; 3=Lisbon; 4=Alentejo; 5=Algarve; 6=Azores; 7=Madeira	3.610	1.991	1	7